ON THE INTERACTION OF VELARS AND LABIALS

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Abstract[1]

The paper treats data from a wide range of languages to show, on the one hand, that there is pervasive direct interaction between labials and velars to the exclusion of coronals, and, on the other hand, that the drive behind these phenomena is simply the presence of labiality in labials and the lack of any place specifications in velars. These data then further support the view that velars lack place specifications altogether, a view presented in Huber 2004b contra Paradis and Prunet 1991. Most importantly, the paper clearly shows that all these phenomena are in fact prosodic phonologically conditioned and absolutely regular, rather than random or unprincipled changes. On this basis, the paper sets up a new typology of the phenomena, which better captures the phonological conditions underlying them.

0. Introduction - the wider perspective of the research on velars

The present paper treats only one aspect of the thesis that all the observable phenomena related to plain velar consonants (notably /k g x ɣ ŋ/) can be accounted for if no phonologically relevant place of articulation is assumed in velars. In other words, the phonological representation of velar segments lacks any place specifications. This stance is not the mainstream opinion (cf. Paradis and Prunet 1991). However, arguments in favour of this view come from a number of directions such as issues of markedness, interactions between velars and palatals as well as issues of epenthesis, among others —all of them are topics already discussed elsewhere at some length (see Huber 2002, 2003a, 2003b, 2004a and 2004b). The topic of the present paper, the interaction of velars and labials, provides, in particular, a surprisingly rewarding area where the thesis can be affirmatively tested.

The data to be discussed below illustrate, on the one hand, that there is pervasive direct interaction between labials and velars, crucially excluding any coronal (or dental) involvement in these phenomena. Since the coronal (dental) space is excluded, these changes cannot be attributed to any place assimilation effects on the production side. Indeed, some authors (e.g. Ferreiro 1999: 116 and Schmidt 1993: 68)

[1] This paper is a considerably expanded chapter of (Huber 2002), of which Huber 2004b is a shortened version.

stress the acoustic similarity of velars and labials, that is, they attribute a central role to perception. On the other hand, the data presented below also support the view that the drive behind these phenomena is simply the presence of labiality in labials (expressed as some feature or element in phonological theories) and the lack of any place specifications in plain velars (features or other). The evidence presented here (and their theoretical account) clarifies an important point in the discussion, namely, what supports that velars can be said to lack a place of articulation.

The paper is structured as follows. In section 1, a preliminary typology of the relevant phenomena is presented (largely based on Huber 2002: 31-35 and Huber 2004b: 27-30). Section 2 presents an extensive range of labial-velar interactions attested mainly in the diachronic changes of quite a number of languages. Section 3 is an attempt to analyze the data in the framework of Government Phonology (with only a brief explanation of the necessary theoretical assumptions, though). The last section summarizes the findings, and references close the paper.

1. About the typology

There seem to be at least two ways to classify the various phenomena that show interactions between labials and velars: (1) whether they occur frequently in natural languages; and (2) whether there is some phonological motivation behind the phenomena. The second approach is admittedly and conspicuously more phonological, while the frequency approach will turn out to be the result of mere lack of data and their unsatisfactory understanding. In Huber (2002, 2004b) no typology had been set up, although a mixture of these two approaches is implicit. The combined approach seemed promising there since the primary emphasis was on drawing attention to the facts themselves, hardly ever described systematically in the phonological literature, while trying to give a theoretical account for most of the phenomena concerned at the same time and pointing out more problematic cases. Consequently, cases that could be handled more easily in the theory were termed 'typical' phenomena while others were termed 'atypical'. This is presented in (1) below. Since this typology is a convenient point of departure for the following discussion of the individual cases, reference to the later sections of this paper is also indicated below.

(1) The typology (to be modified):
2.1 Typical (=frequently attested) phenomena:
2.1.1 Non-phonologically conditioned phenomena
2.1.2 Phonologically conditioned phenomena
2.2 Atypical (= less frequently attested) phenomena

Interestingly enough, the various interaction phenomena have turned out to show a biased combination of these two perspectives in that atypical phenomena tend to be phonologically conditoned while typical phenomena are either so conditioned or not. The most important conclusion here will be that all these phenomena are in fact phonologically conditioned and regular: certain changes systematically occur in prevocalic, others in preconsonantal and word-final contexts. This will lead to a reconsideration of the initial typology shown in (1).

The most important point, however, in the subsequent argumentation is that all the observed phenomena can be directly explained by the presence or absence of a labiality element (the equivalent of [+labial] in featural terms), which is assumed in labials anyway (cf. Harris and Lindsey 1995: 65-73, Cyran 1997: 24). Velars, it will be shown, do not need to be assumed to have place specifications at all.

2. The data and their analyses

2.1. Typical phenomena

2.1.1. Non-phonologically conditioned phenomena

2.1.1.1. Among the Indo-European (IE) languages, members of the Celtic branch have been cited most often to show a well-known phenomenon where an IE labio-velar consonant (for instance /k^{w}/) turns either into a plain velar or labial. Of particular interest here is, of course, the change to a plain labial. Two paradigm examples for the change in Celtic are shown below with some other IE cognates for the sake of comparison:

(2) IE *e*k^{w}*o- 'horse' > Ogam Irish e*ch* /ex/ versus Welsh e*b*ol 'colt' (Schmidt 1993: 68)

also > Latin e*qu*u- /-kw-/, Old English eo*h* /-x/

> AncGrk hi*pp*o- /-pp-/

IE *-*k^{w}*e 'and' > Lepontic Celtic -*p*e /p-/ (Eska-Evans 1993: 44)

also > Latin -*qu*e [kwe] > Spanish *qu*e [ke]

As can be seen, Indo-European *k^{w} turned into /p/ in the so-called P-Celtic languages such as Welsh and Lepontic, while it remained a velar, even if later simplified to a plain /k/, in Q-Celtic languages such as Ogam (Old) Irish. Based on this dialectal feature, Celtic languages fall into two types as charted below (Schmidt 1993: 68, also cited in Huber 2004b: 28):

(3) *k^{w} > /k^{w}/ (> /kw/) in Celtiberian, Ogam Irish, Archaic Gaulish

> /k/ in Goidelic: Modern Irish, Scottish Gaelic

> /p/ in Brythonic: Welsh, Breton; Lepontic (Gaulish)

What is significant phonologically at this point is the observation that these changes to /p/ are not conditioned by a triggering segment in the environment of the labio-velar consonant. In other words, the development to /p/ is not the result of any kind of place assimilation or other. At the same time, it is equally obvious that the labial glide /w/ in the labio-velar is the only possible source of the labiality. It is a case of reconfiguration then within an initially complex segment. Although there is no contextual triggering segment, there is phonology behind the curtains —but let us see some other examples first.

2.1.1.2. Some examples for the very same kind of splits are also attested in other IE languages, which shows that the change is far from being irregular, exceptional or

rare in any sense. For instance, Latin, as we have just seen, had retained the labio-velars. From the Italic languages, however, Latin is the only such variety, since neighbouring Osco-Umbrian varieties came up with plain labial reflexes uniformly. This means that the Italic branch showed exactly the same kind of dichotomy as did the Celtic branch, with Latin retaining labio-velars while other Italic languages turning them into labials. The correspondences are regular between Latin /kw/ and Osco-Umbrian /p/ as far as the scarcity of Osco-Umbrian data allows us to see. The following is a brief illustration:

(4)

Latin	Oscan	Umbrian	
*qu*is /kw-/	*p*is /p-/	*p*isi /p-/	'who?' (Fodor 2000: 1494)

a sentence in Oscan: *status* */p/us set* *hurtin* (Fodor 2000: 1122)
statues which are in the garden

Continuing with the discussion of Latin, it is noteworthy that some Romance languages turned Latin labio-velars into plain labials. Romanian and Sardinian have this feature, again without any contextual restrictions. The Romanian data also reveal that both voiceless /k^{w}/ and voiced /g^{w}/ were affected. Here are some examples from Romanian and Sardinian with the corresponding Latin items (data from Tamás 1976):

(5)

Latin	Romanian	Sardinian	
/kw/	/p b/	/p b/	
a*qu*a	a*p*ă	a*bb*a	'water'
e*qu*a	ia*p*ă		'mare'
li*ngu*a	li*mb*ă		'language'
ada*qu*are	adă*p*ă		'to take to water'
*qu*attro	*p*atru	*b*attoro	'four'
*qu*i	*p*e		'that <conj.>'
ci*nqu*e		ki*mb*e	'five'

As for other Indo-European languages, the Germanic branch, for instance, preserved the IE labio-velars, which show, of course, later effects of Grimm's Law: IE *k^{w} > /x^{w}/: as in OE *hwa* 'who', OE *hwat* 'what', and IE *g^{w} > /k^{w}/: as in OE *cwicu* 'alive' (> E *quick*), Dutch *kwi(e)k* 'quick, alive', IE *g^{w}ena > OE *cwena* 'woman' (> E *queen*), Southern Dutch *kween* 'old woman'. Slavic languages merged labio-velars into plain velars, original palatal velars having become some sibilant (other satem languages had similar reflexes).

There are some sporadic alternations, nevertheless, whose theoretical importance seems to be little (data partly taken from Huber 2004b: 29):

(6) Sporadic correspondences

/f, v/	/k, kw/
wol*f*	Old Slavic *wil*ku* > Czech *vlk* 'wolf', Polish *wilk* 'wolf', etc.
*f*our	L *qu*attuor, *qu*artus
*fiv*e	L *qu*in*qu*e

The word *wolf* seems to be an isolated example. Since the word-final /f/ comes regularly from /p/ as derived by Grimm's Law, the change to /p/ must have preceded the Germanic Consonant Shift. It is interesting that Latin also has *lupus* 'wolf' with /p/, which is unexpected. The only explanation (if borrowing from, say, Osco-Umbrian can be excluded) is phonetic in nature: the neighbouring /u/ may have had an influence on the etymological /kw/. The Germanic word for *four* also goes back to an initial IE /k^{w}/. A standard explanation in this case, however, is the analogical influence of *five*, which regularly goes back to an etymological IE /p/. In this latter word, however, Latin shows analogical influence since the initial *kw-* of the cluster in *qu*in*que* is not etymological. It is either the influence of Latin *quattuor* 'four', or the assimilation of the second /kw/ of *quinque*. Nevertheless, the examples in (6) are considered slightly deviant in form; they do not represent the regular state of affairs, which is that Latin and Germanic both preserved the IE labio-velars and Slavic (as well as other satem languages) came up with plain, but still velar, reflexes.

2.1.1.3. Ancient Greek is more revealing than it might seem at first sight, therefore it deserves attention. Ionic and Attic dialects of Ancient Greek show some remarkable changes of IE labio-velars *k^{w}, *g^{w}, *g^{wh}. On the one hand, there are regular plain labial reflexes of IE labio-velars: Lat *se*[kw]*i-* - Gr *(h)e*[p]*e-* 'follow', Gmc [k]*u* - Gr [b]*ous* 'cow', etc. However, the fate of these clusters seems in fact to have been determined by the following vowel: only when the vowel was one of the back vowels /a o u/, did the change to a plain labial ensue. When the following vowel was front /e i/, developments to dentals are found instead, which is truly remarkable. The data in (7) below show some examples for the changes to dentals:

(7)	*k^{w}	→ t		*k^{w}e	> /t/e	'and'
				*k^{w}is	> /t/is	'who?'
				*k^{w}et^{w}ores	> /t/ettares	
					or /t/essares	'four'
				*penk^{w}e	> pen/t/e	'five'
				*k^{w}ei/k^{w}oi/k^{w}i	<root of 'pay'>	
				*k^{w}i-ti-	> /t/i-sis	
			but:	*k^{w}oi-neh$_2$	> /p/oiné	
	*g^{w}	→ d	* n̥-g^{w}en- > a-/d/en-(os) (cf. Lat. in-/gw/en 'hips, waist')			
			(before /i/, however, often: *g^{w}iyos > /b/ios 'life', */d/ios)			
	*g^{wh}	→ t^{h}		*g^{wh}en-je/jo-	<thematic impf. of 'kill'>	
				*t^{h}en-jó	> 1sg. /th/einó	
			but:	*g^{wh}on-o-s	> /ph/onos 'murder, killing'	

There are then morphological alternations between /p b p^{h}/ and /t d t^{h}/ in Ancient Greek, but their actual morphophonological status is not investigated here. (It also has to be recalled that non-Attic varieties had regular developments such as IE *pen*k^{w}*e 'five' > pen/k/e.) The general developments in the Ionic and Attic dialects can be summarized as follows:

(8)

IE *k^w-		/t-/
IE *g^w-	>	/d-/ / _____ [+front]
IE *g^{wh}-		/t^h-/

Elsewhere: /p b p^h/, respectively.

It is truly noteworthy that in this case reference must be made to a following vowel, and also that all IE labio-velars are uniformly affected. This is going to gain importance in the following discussion. As for the actual motivation for this surprising change to dentals, some sort of palatalization is at work, but the details are not relevant in this discussion (see Rix 1976: 87).

There is a further complication in Ancient Greek, however. As early as Pre-Mycenean Greek, a change of the form *k^w > /k/ / _u or u_ took place, that is, *k^w became plain /k/ in the vicinity of /u/. In this variety, however, all other labio-velars remain intact. The word for 'shepherd' illustrates all the Ancient Greek changes particularly well. In Mycenean Greek, there is /*gw*ou*k*olos/ 'shepherd' rather than */*gw*ou*kw*olos/: the only change here is the simplification of the middle complex labio-velar. If one compares this with the (later) Attic Greek form /*b*ou*k*olos/, then both the rather early change *k^w > /k/ and the later Ionic-Attic developments of the initial /g^w/ to /b/ can be seen.

A parallel development to that just described in Pre-Mycenean Greek, that is, delabialization under the influence of a neighbouring labial vowel, also occured in Germanic languages where reflexes of IE *k^w have become simple /k/ before a labial vowel (and also at the end of words). Compare IE *g^wou- > Gmc *cu* > English *cow* / kau/, Gm *Kuh* /ku:/, D *koe* /ku:/ with simplification versus *cwicu* 'alive' with retained /kw/. Evidence for the original presence of /kw/ comes from Dutch, for instance, where the preterite form of the verb 'come' is still *kwam* (singular) -*kwamen* (plural) with /kw/ retained, while all other forms show the loss of the labial glide /w/: *komen* / **kwomen* 'to come' and *gekomen* / **gekwomen* 'come <past participle>'. This preterite form is also attested in Old English: *cwom* 'came' as opposed to the simplified form in, say, *cuman* 'to come'.

Returning to the discussion of Latin and Ancient Greek, one more important observation is in order here. In Ancient Greek simple /k/, which could occur either preconsonantally or prevocalically, does not undergo any changes comparable to those above:

(9)

	Latin	Ancient Greek	
	se[ks]	he[ks]a	'six'
	de[k]em	de[k]a	'ten'
	[k]entu-	(he)[k]ato-	'(one) hundred'
but:	se[kw]i-	(h)e[p]e-	'follow'
	e[kw]u-	hi[pp]o-	'horse'

This observation is important because it shows that only complex labio-velars underwent the change, simple velars did not.

2.1.1.4. An important point in the theoretical analysis, to rush ahead a little, is the relevance of whether a sequence /kw/ or a single but complex phoneme /k^w/ is

assumed. The straightforward answer is that it does not matter. In fact, there is by and large agreement (see any handbook on IE comparative linguistics) that IE had labio-velar phonemes such as /k^w/ rather than sequences of a velar followed by a labial glide as in /kw/, for example. Evidence comes from metrical facts in diction, syllabicity facts and, of course, later historical developments. Now it will suffice to point out that assuming a sequence runs into a problem difficult to evade. Namely, if /k^w/ is really /kw/, then it has to be explained why /tw/, for instance, did not behave like /kw/ and, in particular, why it did not change into a plain labial in the course of time. This means in practice that the changes from a labio-velar (and exclusively from these) to a plain labial could only happen at a time when the original sounds were (still) a single phoneme.

2.1.1.5. Turning away from Indo-European languages, the following switches between Standard Chinese and Santai Chinese lend additional support for the view that only complex labio-velar segments, occupying one single timing unit, are capable of either splitting or switching. Duanmu cites (2002: 85) the minimal pairs in (10a) for such regular switches between the two Mandarin varieties, Standard Chinese (SC) and Santai Chinese. He also cites some words in (10b) for the lack of switches, to illustrate his point:

(10)	Standard Chinese	Santai Chinese	
(a)	[hwəi]	[fəi]	'ashes'
	[fəi]	[hwəi]	'to fly'
	[hwaŋ]	[faŋ]	'yellow'
	[faŋ]	[hwaŋ]	'house'
(b)	[hən]	[hən]	'very'
	[hau]	[hau]	'good'

What is a labio-velar in SC is labial in Santai and vica versa (10a), while plain velars do not show such switches (10b). In analyzing the phoneme inventory of SC, Duanmu considers [h] to be one of the realizations of the velar fricative /x/ (2002: 27), which means that the above data are rightly considered to be labial-velar interactions. From the data above it is apparent that only the labialized velar [h^w] switches to [f] and vica versa, while plain [h] never does. He argues convincingly at great length (2002: 82-89) that a prenuclear glide (a /w/ in the case at hand) does indeed belong to the onset (it shares its timing slot). Consequently, the switches in (10) are only possible if [h^w] is in fact a single segment rather than a sequence [hw].

In addition, Duanmu has also confirmed (pc, 2005) that there are pairs of words with initial [f] in both dialects: "The only clear case where both dialects (SC and Santai) use [f] is when the vowel is labial, in particular for the syllable [fu1] 'husband' or [fu4] 'father'." And he goes on to say: "Also, there are words where both dialects use [h] [although one would expect alternation; addition mine]. This happens for the syllable 'fire', which is [hwo3] in SC and [ho] in Santai [not *fo; add. mine]. I believe the reason is that Santai does not have the syllable [fo]." What becomes clear from this comment is that the presence, in both dialects, of word-initial /f/ and the lack of expected alternation is due to the presence of a following labial vowel. Although the alternations in (10) support the view of the single segment analy-

sis, there is a problem: why does the switch work in the f -> x^w direction as well (cf. 10a)? In this case, it seems, an original plain labial splits into a labio-velar —this is odd. Furthermore, it would be good to know whether there are such switches among other labials and velars as well, in particular with stops. Further investigation is needed here.

Notwithstanding these additional remarks, the data in (10) and the earlier Ancient Greek phenomena in (9) show that the relevant conclusion is that only single, if complex, labio-velars undergo a change to plain labials.

In connection with this latter claim, namely that only labio-velars can turn into labials while plain labials cannot turn into labio-velars, it has to be shown why the well-known diachronic change */f/ > /h/* in Spanish is not a counter-example. It is known that Latin initial /f/- changed to /h/- in Spanish as well as in some other neighbouring Romance varieties such as Gasconian (where it is much more consistent than in Castilian Spanish by the way). In this case, a plain labial /f/ turns into a plain velar /x/ (which was realized as [h] and still later disappeared altogether) in exactly the same prevocalic position as did all the other phenomena treated so far. What is peculiar is that /p/, for example, does not undergo similar changes. Lapesa (1981: 38) attributes this change to a Basque substratum since Basque "seems to lack original /f/; in Latinisms it tends to omit it (*filu* > *iru*; *ficu* > *iko*) or substitute it with /b/ or /p/ (*fagu* > *bago*; *festa* > *pesta*). Moreover, Basque —including Vizcayan throughout the Middle Ages— used to have an aspirated /h/ which could also substitute /f/, with which it alternates." Lapesa (ibid.) writes that "the initial focus of the phenomenon is limited in the ninth to twelfth centuries to the north of Burgos, La Montaña and Rioja." What all this means for the present discussion is that this particular change happens to be a case of sound substitution, originally in Basque, from which it spread to areas under Basque influence —such is not the case in any of the phenomena discussed so far. In addition, this change is far from being as regular as any of the cases presented above.

All in all, these Spanish cases do not pose a serious objection to the claim that only complex labio-velars can undergo a change to plain labials, not the other way round.

2.1.1.6. A number of important conclusions emerge from the preceding discussion. First of all, although there is no contextual phonological motivation for the various phenomena, all the above changes seem in fact to be phonologically conditioned since they occur pre-vocalically and not pre-consonantally. This is true for all the phenomena discussed above: for the Celtic divisions into P-Celtic and Q-Celtic, Italic varieties (both Ancient and Romance), as well as the switches between Standard and Santai Chinese. In this way then, all velar-labial interactions are (prosodic) phonologically conditioned. This is a major observation, which has tended to be overlooked in the literature (including Huber 2002 and Huber 2004b). Second, the above changes provide considerable support for the view that only complex labio-velars can turn into plain labials (or plain velars, of course). Plain velars and plain labials cannot undergo any comparable changes: e.g. k^w > p and h^w > f are possible changes, while neither *k > p, *x > f, nor *p > k, *f > x are attested prevocalically (recall that the Spanish change is irrelevant).

2.1.2. Phonologically conditioned phenomena

These phenomena, similarly to those in 2.1.1 above, also lack a triggering environment. The phonotactic environment is readily seen, however: these changes occur before a consonant or both before a consonant and a word boundary. As for the changes themselves, here plain labials lose their labiality and become plain velars. These are typical lenition cases. (The Dutch and English changes have been treated at some length in both Huber 2002 and Huber 2004b, while Huber 2002 treated Romanian in a preliminary way).

2.1.2.1. Dutch shows reflexes of a diachronic change where a labial turned into a plain velar in preconsonantal positions. Here are some comparative data that show cognates of Dutch words in English and German (in Dutch < ch > represents /x/):

(11) the rule: Dutch: /f/ --> /x/ /__C

the cognates:

Dutch	English	German
ko*p*en > ko*ch*t 'to buy, bought 3Sg'	chea*p*	kau*f*en 'to buy'
beru*ch*t 'notorious' related to *beroe*[p]*en* 'to be called'	—	beru*f*en 'to be called'
gra*ch*t <type of channel> <D *gra*[v]*en* 'to dig out'	gra*v*e	gra*b*en 'to dig'
klu*ch*t <type of comedy; farce> related to D *kloo*[f] 'split, gap'	clea*v*e	kla*ff*en 'to gape'
a*ch*ter 'behind'	a*f*ter	
kra*ch*t 'power'	cra*f*t	Kra*f*t 'power'
lu*ch*t 'air'	lo*f*t	Lu*f*t 'air'
sti*ch*ting 'fund'	—	Sti*f*tung
za*ch*t 'soft'	so*f*t	san*f*t

The data above reveal that the change occurred irrespectively of the nature of the preceding vowel, both front and back vowels could appear there. What is also shown by the data is that the change was likely to occur only before a /t/. In fact, van der Wal (1992: 30) gives the rule in the form: ft > cht (= [ft] > [xt]) in Old Dutch, more precisely in Old Hollands, not in other Netherlands varieties. The problem that immediately arises is why the change is restricted to this environment. This will have to be treated elsewhere, though.

2.1.2.2. Northern Russian has a similar phenomenon where a labial turns into a plain velar preconsonantally and word-finally. This change is then different from the Dutch cases above in an important respect: it is not restricted to preconsonantal environments, rather it applies at the end of words, too. (12) illustrates the reflexes of Old Slavonic *w in Standard Ukrainian, Standard Czech, Standard Russian and Northern Russian in word-initial, preconsonantal and word-final positions (data from Cyran-Nilsson (1998: 90), highlighted parts in IPA:

(12)	St Ukr	St Czech	St Russian	Northern Russian	gloss (St Russian)
	vOda	vOda	vAda	vAda	'water'
	ła*w*ka	la:*f*ka	ła*f*ka	ła*x*ka	'fixed bench'
	sli*w*	slO*f*	słO*f*	słO*x*	'word'

Without going into the peculiarities of the individual languages, suffice it to say that reflexes of *w show a tendency to strengthen to fricatives in more and more environments. East Ukrainian (not represented above) is the most conservative because it retains /w/ in all original environments. Standard Ukranian has fricative /v/ word-initially, but /w/ elsewhere, Standard Czech and Standard Russian pattern alike since they have /v/ word-initially and /f/ in the other two environments (they differ in more special environments not cited above). Northern Russian went furthest in that it has /v/ word-initially but turned /f/ to /x/ when word-final or before a consonant. The problem that arises if one compares Dutch and Northern Russian is why Dutch does not have that change word-finally as well? A discussion will follow later.

To conclude this section, all the typical phenomena are phonologically conditioned, more precisely, they are prosodically conditioned (there is no contextual reason at all) since they occur before a consonant or both before a consonant and a word boundary. That these labial-velar changes occur in prosodically defined environments is exactly what has been found to hold for all the cases in 2.1.1 as well.

2.2. Atypical phenomena

These are all cases where a plain velar becomes a labial, which is in stark contrast to an earlier conclusion (in 2.1.1.6 above) that only complex labio-velars can undergo splits to a plain labial. (Recall that a possible case of plain labials turning into plain velars, in Spanish, has been refuted above). What is more, these atypical changes always occur in phonologically weak positions: in pre-consonantal and word-final positions (just like in 2.1.2.2 Northern Russian above). That these are called atypical is due to the initial difficulty in explaining them rather than their actual rarity in languages (cf. Huber 2004b). In fact, they are phonologically absolutely regular, but this time the nature of the preceding vowel does have a role to play here: these changes took place after labial vowels, and only later could they spread further.

2.2.1. Old English plain velars turned into labials before a consonant or at the end of a word in Middle English times. It is true, though, that the change only occurred after back vowels, never after front vowels where the original velar fricative vocalized and came to form diphthongs. Moreover, this change does not apply word-initially since there it regularly gave /h-/ as in house, home, etc. Here are some examples for the change to labials:

(13) the rule: (Middle) English: /x/ --> /f/ /__C/#

some examples with /-f/ (spelt <gh> today) and their Germanic cognates with velars:

clou*gh*	Scots *cleuch* /klu:x/
cou*gh*	Du *kuchen*
enou*gh*	G *genug*; Du *genoeg*
lau*gh*	G/Du *lachen*
rou*gh*	Du *ruig* (cf. G *rauh*)
trou*gh*	G *Trog*; Du *trog*

and some others:

chou*gh*, slou*gh* (of a snake), tou*gh*

also preconsonantally:

lau*gh*ter, drau*gh*t (cf. dra[g], dra*w* < dra*w*e < dra*g*e; G *tragen*)

These (Middle) English developments are a mirror image of Northern Russian above in the sense that exactly the reverse change happens in exactly the same environment. This change, it has to be repeated, occurs after back vowels only, more precisely after labial vowels. There is only a handful of examples with /a/ and these can be analogical in fact.

2.2.2. In Romanian a plain velar turned into a labial before a consonant, but not at the end of words. Parallel developments are also attested in Dalmatian, an extinct language. That the change could originally be restricted to positions following a back (or more precisely, labial) vowel is indicated by the Dalmatian data: Latin *octu* gave Dalmatian *guapto* 'eigth', *cognatu* gave *comnut*. Also, in Albanian, traces of the same development are restricted to positions following a back (labial) vowel: Albanian *lu/ft/të* < Latin *lu/k/ta* (Tamás 1976: 67). Romanian, however, seems to have extended the rule as the following data testify (from Tamás 1976):

(14) the rule from Latin to Romanian: /k g ŋ/ > /p b m/ /___C

the data:

drea[pt]ă	'right'			< Latin dire[kt]-
dre[pt]	'straight, direct'			< Latin dire[kt]-
fa[pt]	'fact'			< Latin fa[kt]-
la[pt]e	'milk'			< Latin la[kt]-
lu[pt]ă	'fight'			< Latin lu[kt]a-
noa[pt]e	'night'			< Latin no[kt]-
o[pt]	'eight'			< Latin o[kt]u-
coa[ps]ă	'thigh'			< Latin co[ks]a
cu[mn]at	'male relative'	<	[ŋn]	< Latin co[gn]atus
pu[mn]	'fist'	<	[ŋn]	< Latin pu[gn]u-
se[mn]	'sign'	<	[ŋn]	< Latin si[gn]u-

Notes: (1) the occasional diphthongs <ea, oa> are later regular Romanian developments; (2) the [gn] > [ŋn] is regular too.

The Romanian changes are a mirror image of Dutch above since word-finally no change occurs in either, but Romanian has exactly the reverse change. It might be worth recalling that Romanian also retained original preconsonantal /p/'s (cf. *şapte* < Latin *septem* 'seven'), which is unique among Romance languages, and that Romanian regularly turned labio-velars to plain labials anyway (see (5) above). All in all, there is quite some labial dominance in Romanian.

The intriguing problem in the English and Romanian data is where these labials could possibly get their labiality from. Probably it is not irrelevant that the changes are either still restricted to positions after a back (possibly labial) vowel (in English) or at least they used to be so restricted (in Romanian). A possible account for this phenomenon following King's idea will be presented in the following section.

3. The analyses

As had already been indicated in the Introduction, a major observation in connection with labial-velar interactions is that they cannot be easily attibuted to assimilations on the production side. The acoustic similarity, that is, the perception side of the phonological component, however, has been, noted by a number of authors. Probably Ferreiro (1999: 116), writing about the history of Galician, had some similar observations in mind when he commented on this change to a labial as "being utterly natural". Schmidt (1993: 68) similarly notes that labials and velars are acoustically nearly equivalent. (It has to be noted here that labiovelars of the /kp gb/ type have been excluded altogether from the discussion. They will have to be treated elsewhere).

In works of Classical Generative Phonology, say in SPE, the feature [grave] had been introduced to subsume labials and velars as well (see Durand 1990 for an overview). This is a perception feature which is in opposition with [acute] positively specifying coronals. It has to be noted as well that, since every segment had to be specified in that framework, velars were defined in SPE as [-labial] and [-coronal], that is, no independent feature was assumed which could define velars positively. This observation should not be neglected.

Government Phonology, without going into the peculiarities of the framework, sees the various phonological phenomena to be deducible from a strictly limited number of possible interactions between strictly adjacent segments. In fact, the only possible effects are termed *licensing* and *government*: licensing makes the realization of a segment possible while government exerts various effects that reduce the capacity of a segment to appear in a given position and thereby to deprive segments from their inherent properties ("consonants are mute, vowels are loud"; recall the Latin grammatical term *mutae* for stops; cf. Szigetvári 2001: 56). Both these forces apply from right to left (at least in the standard version of the theory, cf. Charette 1992, Harris 1997, Szigetvári 2001). In Government Phonology, the binary features of earlier frameworks are replaced by privative elements (cf. Harris and Lindsey 1995). Labials, in particular, have a place element U which defines their lip-rounded pronunciation. Velars do not have an element of their own, which is the simple translation of the lack of labial and coronal properties expressed as [-labial, -coronal] in the earlier SPE

theory. The lack of an independent element defing velars naturally follows from SPE features and it will be the basis for the following analyses.

As has been established above, the Celtic and other changes from labio-velars to plain labials (e.g. /kw/ > /p/) in (2-10) do not have contextual conditioning, rather they are prosodically conditioned by the prevocalic environment. They can be analysed as a simple case of internal restructuring of a segment (the promotion of U labiality to head position):

(15a)	k^w ===> p	versus	(15b)	k^w ===> k	
	[ ] [U]			[ ] [ ]	
	\			\	
	[U]			[U]	

At this point in the argumentation it is important to realize that it is not absolutely theoretically necessary that a velar lacks a place specification. Consider the possibility that there is indeed an element in the representation of velars. Either choice is possible for the representation in (15b). In (15b) all that happens is that the labiality of the secondary articulation disappears while nothing happens to the rest of the segment (and its representation). If an element were assumed in velars, it could still happily survive. In (15a), on the other hand, it does matter whether place specification is assumed in velars or not because in this case it has to be explained how the actual switch from velarity to labiality comes about since, as has been stated above, there is no phonological conditioning in the environment. In other words, there is no source for the labiality. Notice that the supposed velarity element has to be delinked (to use a well-known term) in the first step and the labiality element must be then promoted to the position it occupies in /p/. There is no theoretical motivation whatsoever for the delinking of the supposed velar element.

Notice at the same time that neither the promotion of the labiality to head position nor its deletion from the secondary position needs any special theoretical machinery: both phenonema are driven by the prosodic environment itself, namely the prevocalic position —a position which is phonologically strong. Here licensing makes segments stable, 'licensed' (see Harris 1997, Szigetvári 2000). Also recall that in this position only complex labio-velars could be shown to change; the single case, in Spanish, of labials turning to velars in this position does not ultimately figure here, and no data were found for a theoretically possible change of velars turning to labials before a vowel. To sum up then, there is no motivation for assuming an element in velars since it would not be used to account for any phonological phenomena (recall Occam's Razor), while the fate of the labiality element —which has to assumed in labials on independent grounds— in secondary position is readily accounted for by the prosodic environment: the prevocalic position.

The Northern Russian change in (12), which occurs preconsonantally and word-finally, is analysed as a case of phonologically conditioned lenition. Here the effect of government is seen to make consonants more like vowels (recall that government destroys the inherent properties of a segment). The labial place element is lost while all other elements like voicing and continuancy are unaffected:

(16) p ===> k similarly: f ===> x
[U] [ ] [U] [ ]

Notice that in earlier featural terms, there was no problem on the formal side of the explanation since a labial segment became a non-labial one. However, an explanation should be found for why, on losing its labiality, the segment in this position gains a velar place of articulation exactly. (If, however, a feature defining velars were assumed, then there must be a reason for that to surface in this context.) Apparently, neither the velarity nor the cause for the [-labial] specification is encoded in the environment. In the government approach, on the other hand, the explanation is straightforward and no appeal has to be made to the segmental environment: the labiality element U is either simply deleted from the representation through government or made impossible by not being licensed. In any case, the segmental environment has no role to play.

To conclude, so far the theoretically more straightforward cases have been accounted for. Two pervasive patterns have been identified. It has been found above that in prevocalic position the strengthening of a labio-velar either to a plain labial or a plain velar results in a more prominent, consonant-like consonant. This is the effect of licensing. In preconsonantal and word-final positions, the loss of the labial element resulted in lenitions of (plain) labials to plain velars. This then is the effect of government. What is important is that the two sets complement each other.

There remain more difficult cases, like the Dutch reduction of labials before /t/ on the one hand, and the Middle English and Romanian changes on the other. In these latter cases, there is indeed a contextual reason for the aquisition of labiality, at least in the original setting. Later changes, however, could result in the extension of this initial pattern to more environments. The basic idea (taken from King 1969) for their treatment is that they can be analysed in terms of well-formedness (phonotactic) constraints banning certain velars in certain environments, these constraints beginning to apply in consecutively more and more environments.

In connection with the Romanian change, Robert D King offers a plausible analysis (1969: 115) in terms of rule addition. (It has to be noted that King aimed at an SPE-type analysis of historical changes). He argues that the change from velar to labial (see data in (14) above) is surprising only if one views this as a change converting a velar segment into a labial one. He proposes instead that the actual change is in the rule component: the addition of a restriction on well-formed structures. While earlier in the history of Romanian there used to be no restriction on a sequence of a non-coronal (labial and velar) and coronal segments, now a rule was introduced of the following form:

(17) Rober D King's analysis (1969):

$$[-\text{continuant}] > [+\text{anterior}] \; / \; \underline{\quad\quad} \; \begin{matrix}[-\text{continuant}] \\ [+\text{coronal}]\end{matrix}$$

What this rule does is to add a restriction to the system to the effect that before a coronal non-continuant only a [+anterior] segment is allowed. This rule crucially does not say that a velar becomes something else, but that before a non-continuant

coronal there can only appear a [+anterior] sound. Obviously, the rule applies vacuously to labials as well. It should be borne in mind that King also expresses the view that the labial in fact does not come from the velar. What is particularly attractive in King's analysis is that it can be extended to the (Middle) English and Dutch data as well: a rule can be added to exclude certain sequences. Although this solution is rather attractive, some questions remain. For instance, it is not immediately clear why the [+anterior] happens to be a labial, since an Italian-style solution with coronal gemination would also meet this restriction (cf. Italian *notte*, *fatto*, for instance). Of course, one could add a rule prohibiting geminate consonants in Romanian, so this is not a serious problem. It is more problematic, though, that the reasoning is difficult to test since there is no other set of segments other than the velars that would show the effect of this rule addition. Notice that the same objection cannot be raised against the Dutch restriction since there even stop /k/ turns into /x/ regularly before another non-continuant: *zoek-* [-k] - *zocht-* [-xt] 'look for <pres>, <past>'. Nevertheless, this approach is important since King excludes the alternative route along some /k/ > /k^{w}/ > /p/ trajectory, which is totally unsupported by the data anyway and it is absolutely unnecessary once one rejects the claim that it is sounds rather than grammar that changes. As a final remark on this analysis, this change is a nice symmetrical twin of what was observed in Dutch: in Dutch a restriction was introduced to exclude labials, in English and Romanian it is velars that are excluded by a structurally identical constraint.

King thus treats this particular change as a change in the rule component rather than an extension of a minor regularity to more and more environments. This latter possibility cannot be excluded, however, at least in a number of cases. Although it was mentioned in the preceding paragraph that this change is attested not only in words that have a neighbouring labial vowel, it can still be the case that indeed those were the first instances of the change, and later the rule extended its scope to all back vowels. In fact, the Dalmatian and Albanian data cited in 2.2.2 do show such a scenario. (This is a possible chronology for the English *-gh* words, too).

There is a final point to be considered. One important aspect of the various velar-labial interactions has been neglected so far: what impact all these changes have on the phoneme inventories of the respective languages. An important observation in connection with the Romanian, Dutch and English changes is that these phonotactic rule additions do not affect the phoneme inventory of the language, they only change some distributions in it. These rules do not delete a phoneme from the inventory or add a new phoneme to the system. In Romanian, /k/ can and does appear word-initally or intervocalically in words of Latin origin; similarly in English word-initial /x/ did not disappear but it gave /h/ as in *house*; also in Dutch, word-final /f/ is free to occur. Only, they are banned in some environments. However, in languages where labio-velars were affected before a vowel (Celtic and Greek), the (original) labio-velars did not survive, the inventory lost these phonemes altogether.

It is more than tempting to collapse this observation on phoneme inventories with the changes in the various prosodic environments. This gives a better and truly phonological typology of the velar-labial interactions across languages. In prevocalic position labio-velars undergo changes to plain labials (or velars) and this reduces the phoneme inventory. In preconsonantal and word-final positions, reductions of labials

to velars is only prosodically conditioned, the quality of preceding vowels is absolutely immaterial for the changes. On the other hand, changes of velars to labials only happen if there is a preceding conditioning labial vowel as well. In this environment, thus, the unmarked process is from labial to velar, the reverse process needs the conditioning of preceding labial vowels. Any of the these changes in preconsonantal and word-final positions leaves the inventory intact.

These observations amount to saying that all labial-velar interactions are exclusively prosodically conditioned, the segmental environment only has a role in the marked process of velars turning to labials, and only the peceding labial vocalic environment matters even in those cases. The revised typology looks like this then:

(18) The revised typology:
A Phoneme inventory affected > changes in __V (2.1.1)
1 Changes from labio-velars to plain labials and velars (2.1.2)
B Phoneme inventory not affected > changes in __C/#
2 Reductions of labials to velars is only prosodically conditioned
3 Velars turn into labials only when there is labial vowel preceding (2.2)

4. Conclusions

There are a number of important conclusions reached in the preceding discussion on the various interactions between labials and velars. Firstly, although there is no contextual phonological motivation for phenomena where a labio-velar turns into a plain labial (or velar), all such changes are phonologically conditioned since they occur prevocalically. Plain labials show reductions to velars, and plain velars turn, under strict conditions, into labials in preconsonantal and word-final positions. In consequence, all velar-labial interactions are (prosodic) phonologically conditioned. Secondly, considerable support was found for the view that only complex labio-velars can turn into plain labials (or plain velars, of course). Plain velars and plain labials cannot undergo any comparable changes to labio-velars. Thirdly, there is no motivation for assuming an element in velars since it would not be used to account for any phonological phenomena. Fourthly, changes of velars to labials can only occur if there is a preceding labial vowel. Later in the history of a particular language, this environment can extend to cover more and more contexts. This step can be best captured by phonotactic rules. And finally, while these latter phonotactic rules do not affect the phoneme inventory of the language, only some distributions in it, changes of labio-velars typically reduce the inventory. These observations can be united in the revised typology in (18).

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